

What is claimed is:

1. A system for detecting an analyte in a fluid comprising:

5 a light source;

a sensor array, the sensor array comprising a supporting member comprising at least one cavity formed within the supporting member;

10 a particle, the particle positioned within the cavity, wherein the particle is configured to produce a signal when the particle interacts with the analyte during use; and

a detector, the detector being configured to detect the signal produced by the interaction of the analyte with the particle during use;

15 wherein the light source and detector are positioned such that light passes from the light source, to the particle, and onto the detector during use.

20 2. The system of claim 1, wherein the system comprises a plurality of particles positioned within a plurality of cavities, and wherein the system is configured to substantially simultaneously detect a plurality of analytes in the fluid.

3. The system of claim 1, wherein the system comprises a plurality of particles positioned within the cavity.

25 4. The system of claim 1, wherein the light source comprises a light emitting diode.

5. The system of claim 1, wherein the light source comprises a white light source.

30 6. The system of claim 1, wherein the sensor array further comprises a bottom layer and a

top cover layer, wherein the bottom layer is coupled to a bottom surface of the supporting member, and wherein the top cover layer is coupled to a top surface of the supporting member; and wherein both the bottom layer and the top cover layer are coupled to the supporting member such that the particle is substantially contained within the cavity by bottom layer and the top cover layer.

7. The system of claim 1, wherein the sensor array further comprises a bottom layer and a top cover layer, wherein the bottom layer is coupled to a bottom surface of the supporting member, and wherein the top cover layer is coupled to a top surface of the supporting member; and wherein both the bottom layer and the top cover layer are coupled to the supporting member such that the particle is substantially contained within the cavity by bottom layer and the top cover layer, and wherein the bottom layer and the top cover layer are substantially transparent to light produced by the light source.

8. The system of claim 1, wherein the sensor array further comprises a bottom layer coupled to the supporting member, and wherein the supporting member comprises silicon, and wherein the bottom layer comprises silicon nitride.

9. The system of claim 1, wherein the sensor array further comprises a sensing cavity formed on a bottom surface of the sensor array.

10. The system of claim 1, wherein the supporting member is formed from a plastic material, and wherein the sensor array further comprises a top cover layer, the top cover layer being coupled to the supporting member such that the particle is substantially contained within the cavity, and wherein the top cover layer is configured to allow the fluid to pass through the top cover layer to the particle, and wherein both the supporting member and the top cover layer are substantially transparent to light produced by the light source.

11. The system of claim 1, further comprising a fluid delivery system coupled to the

supporting member.

12. The system of claim 1, wherein the detector comprises a charge-coupled device.

5 13. The system of claim 1, wherein the detector comprises an ultraviolet detector.

14. The system of claim 1, wherein the detector comprises a fluorescence detector.

10 15. The system of claim 1, wherein the detector comprises a semiconductor based photodetector, and wherein the detector is coupled to the sensor array.

16. The system of claim 1, wherein the particle ranges from about 0.05 micron to about 500 microns.

15 17. The system of claim 1, wherein a volume of the particle changes when contacted with the fluid.

18. The system of claim 1, wherein the particle comprises a metal oxide particle.

20 19. The system of claim 1, wherein the particle comprises a metal quantum particle.

20. The system of claim 1, wherein the particle comprises a semiconductor quantum particle.

25 21. The system of claim 1, wherein the particle comprises a receptor molecule coupled to a polymeric resin.

22. The system of claim 1, wherein the particle comprises a receptor molecule coupled to a polymeric resin, and wherein the polymeric resin comprises polystyrene-polyethylene glycol-divinyl benzene.

23. The system of claim 1, wherein the particle comprises a receptor molecule coupled to a polymeric resin, and wherein the receptor molecule produces the signal in response to the pH of the fluid.

5

24. The system of claim 1, wherein the particle comprises a receptor molecule coupled to a polymeric resin, and wherein the analyte comprises a metal ion, and wherein the receptor produces the signal in response to the presence of the metal ion.

10

25. The system of claim 1, wherein the particle comprises a receptor molecule coupled to a polymeric resin, and wherein the analyte comprises a carbohydrate, and wherein the receptor produces a signal in response to the presence of a carbohydrate.

15

26. The system of claim 1, wherein the particle comprises a receptor molecule coupled to a polymeric resin, and wherein the particles further comprises a first indicator and a second indicator, the first and second indicators being coupled to the receptor, wherein the interaction of the receptor with the analyte causes the first and second indicators to interact such that the signal is produced.

20

27. The system of claim 1, wherein the particle comprises a receptor molecule coupled to a polymeric resin, and wherein the particles further comprises an indicator, wherein the indicator is associated with the receptor such that in the presence of the analyte the indicator is displaced from the receptor to produce the signal.

25

28. The system of claim 1, wherein the particle comprises a receptor molecule coupled to a polymeric resin, and wherein the receptor comprises a polynucleotide.

29. The system of claim 1, wherein the particle comprises a receptor molecule coupled to a polymeric resin, and wherein the receptor comprises a peptide.

30. The system of claim 1, wherein the particle comprises a receptor molecule coupled to a polymeric resin, and wherein the receptor comprises an enzyme.

5 31. The system of claim 1, wherein the particle comprises a receptor molecule coupled to a polymeric resin, and wherein the receptor comprises a synthetic receptor.

32. The system of claim 1, wherein the particle comprises a receptor molecule coupled to a polymeric resin, and wherein the receptor comprises an unnatural biopolymer.

10

33. The system of claim 1, wherein the particle comprises a receptor molecule coupled to a polymeric resin, and wherein the receptor comprises an antibody.

34. The system of claim 1, wherein the particle comprises a receptor molecule coupled to a polymeric resin, and wherein the receptor comprises an antigen.

15

35. The system of claim 1, wherein the analyte comprises phosphate functional groups, and wherein the particle is configured to produce the signal in the presence of the phosphate functional groups.

20

36. The system of claim 1, wherein the analyte comprises bacteria, and wherein the particle is configured to produce the signal in the presence of the bacteria.

37. The system of claim 1, wherein the system comprises a plurality of particles positioned within a plurality of cavities, and wherein the plurality of particles produce a detectable pattern in the presence of the analyte.

25

38. The system of claim 1, wherein the supporting member comprises silicon.

39. The system of claim 1, wherein the sensor array further comprises a top cover layer, wherein the top cover layer is coupled to a top surface of the supporting member such that the particle is substantially contained within the cavity by the top cover layer.

5 40. The system of claim 1, wherein the sensor array further comprises a bottom layer coupled to the supporting member, and wherein the bottom layer comprises silicon nitride.

41. The system of claim 1, wherein the particles produce a detectable pattern in the presence of the analyte.

10

42. The system of claim 1, wherein the cavity is configured such that the fluid entering the cavity passes through the supporting member during use.

11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60
61
62
63
64
65
66
67
68
69
70
71
72
73
74
75
76
77
78
79
80
81
82
83
84
85
86
87
88
89
90
91
92
93
94
95
96
97
98
99
100
101
102
103
104
105
106
107
108
109
110
111
112
113
114
115
116
117
118
119
120
121
122
123
124
125
126
127
128
129
130
131
132
133
134
135
136
137
138
139
140
141
142
143
144
145
146
147
148
149
150
151
152
153
154
155
156
157
158
159
160
161
162
163
164
165
166
167
168
169
170
171
172
173
174
175
176
177
178
179
180
181
182
183
184
185
186
187
188
189
190
191
192
193
194
195
196
197
198
199
200
201
202
203
204
205
206
207
208
209
210
211
212
213
214
215
216
217
218
219
220
221
222
223
224
225
226
227
228
229
230
231
232
233
234
235
236
237
238
239
240
241
242
243
244
245
246
247
248
249
250
251
252
253
254
255
256
257
258
259
260
261
262
263
264
265
266
267
268
269
270
271
272
273
274
275
276
277
278
279
280
281
282
283
284
285
286
287
288
289
290
291
292
293
294
295
296
297
298
299
300
301
302
303
304
305
306
307
308
309
310
311
312
313
314
315
316
317
318
319
320
321
322
323
324
325
326
327
328
329
330
331
332
333
334
335
336
337
338
339
340
341
342
343
344
345
346
347
348
349
350
351
352
353
354
355
356
357
358
359
360
361
362
363
364
365
366
367
368
369
370
371
372
373
374
375
376
377
378
379
380
381
382
383
384
385
386
387
388
389
390
391
392
393
394
395
396
397
398
399
400
401
402
403
404
405
406
407
408
409
410
411
412
413
414
415
416
417
418
419
420
421
422
423
424
425
426
427
428
429
430
431
432
433
434
435
436
437
438
439
440
441
442
443
444
445
446
447
448
449
450
451
452
453
454
455
456
457
458
459
460
461
462
463
464
465
466
467
468
469
470
471
472
473
474
475
476
477
478
479
480
481
482
483
484
485
486
487
488
489
490
491
492
493
494
495
496
497
498
499
500
501
502
503
504
505
506
507
508
509
510
511
512
513
514
515
516
517
518
519
520
521
522
523
524
525
526
527
528
529
530
531
532
533
534
535
536
537
538
539
540
541
542
543
544
545
546
547
548
549
550
551
552
553
554
555
556
557
558
559
560
561
562
563
564
565
566
567
568
569
570
571
572
573
574
575
576
577
578
579
580
581
582
583
584
585
586
587
588
589
590
591
592
593
594
595
596
597
598
599
600
601
602
603
604
605
606
607
608
609
610
611
612
613
614
615
616
617
618
619
620
621
622
623
624
625
626
627
628
629
630
631
632
633
634
635
636
637
638
639
640
641
642
643
644
645
646
647
648
649
650
651
652
653
654
655
656
657
658
659
660
661
662
663
664
665
666
667
668
669
670
671
672
673
674
675
676
677
678
679
680
681
682
683
684
685
686
687
688
689
690
691
692
693
694
695
696
697
698
699
700
701
702
703
704
705
706
707
708
709
710
711
712
713
714
715
716
717
718
719
720
721
722
723
724
725
726
727
728
729
730
731
732
733
734
735
736
737
738
739
740
741
742
743
744
745
746
747
748
749
750
751
752
753
754
755
756
757
758
759
760
761
762
763
764
765
766
767
768
769
770
771
772
773
774
775
776
777
778
779
780
781
782
783
784
785
786
787
788
789
790
791
792
793
794
795
796
797
798
799
800
801
802
803
804
805
806
807
808
809
810
811
812
813
814
815
816
817
818
819
820
821
822
823
824
825
826
827
828
829
830
831
832
833
834
835
836
837
838
839
840
841
842
843
844
845
846
847
848
849
850
851
852
853
854
855
856
857
858
859
860
861
862
863
864
865
866
867
868
869
870
871
872
873
874
875
876
877
878
879
880
881
882
883
884
885
886
887
888
889
890
891
892
893
894
895
896
897
898
899
900
901
902
903
904
905
906
907
908
909
910
911
912
913
914
915
916
917
918
919
920
921
922
923
924
925
926
927
928
929
930
931
932
933
934
935
936
937
938
939
940
941
942
943
944
945
946
947
948
949
950
951
952
953
954
955
956
957
958
959
960
961
962
963
964
965
966
967
968
969
970
971
972
973
974
975
976
977
978
979
980
981
982
983
984
985
986
987
988
989
990
991
992
993
994
995
996
997
998
999
1000
1001
1002
1003
1004
1005
1006
1007
1008
1009
1010
1011
1012
1013
1014
1015
1016
1017
1018
1019
1020
1021
1022
1023
1024
1025
1026
1027
1028
1029
1030
1031
1032
1033
1034
1035
1036
1037
1038
1039
1040
1041
1042
1043
1044
1045
1046
1047
1048
1049
1050
1051
1052
1053
1054
1055
1056
1057
1058
1059
1060
1061
1062
1063
1064
1065
1066
1067
1068
1069
1070
1071
1072
1073
1074
1075
1076
1077
1078
1079
1080
1081
1082
1083
1084
1085
1086
1087
1088
1089
1090
1091
1092
1093
1094
1095
1096
1097
1098
1099
1100
1101
1102
1103
1104
1105
1106
1107
1108
1109
1110
1111
1112
1113
1114
1115
1116
1117
1118
1119
1120
1121
1122
1123
1124
1125
1126
1127
1128
1129
1130
1131
1132
1133
1134
1135
1136
1137
1138
1139
1140
1141
1142
1143
1144
1145
1146
1147
1148
1149
1150
1151
1152
1153
1154
1155
1156
1157
1158
1159
1160
1161
1162
1163
1164
1165
1166
1167
1168
1169
1170
1171
1172
1173
1174
1175
1176
1177
1178
1179
1180
1181
1182
1183
1184
1185
1186
1187
1188
1189
1190
1191
1192
1193
1194
1195
1196
1197
1198
1199
1200
1201
1202
1203
1204
1205
1206
1207
1208
1209
1210
1211
1212
1213
1214
1215
1216
1217
1218
1219
1220
1221
1222
1223
1224
1225
1226
1227
1228
1229
1230
1231
1232
1233
1234
1235
1236
1237
1238
1239
1240
1241
1242
1243
1244
1245
1246
1247
1248
1249
1250
1251
1252
1253
1254
1255
1256
1257
1258
1259
1260
1261
1262
1263
1264
1265
1266
1267
1268
1269
1270
1271
1272
1273
1274
1275
1276
1277
1278
1279
1280
1281
1282
1283
1284
1285
1286
1287
1288
1289
1290
1291
1292
1293
1294
1295
1296
1297
1298
1299
1300
1301
1302
1303
1304
1305
1306
1307
1308
1309
1310
1311
1312
1313
1314
1315
1316
1317
1318
1319
1320
1321
1322
1323
1324
1325
1326
1327
1328
1329
1330
1331
1332
1333
1334
1335
1336
1337
1338
1339
1340
1341
1342
1343
1344
1345
1346
1347
1348
1349
1350
1351
1352
1353
1354
1355
1356
1357
1358
1359
1360
1361
1362
1363
1364
1365
1366
1367
1368
1369
1370
1371
1372
1373
1374
1375
1376
1377
1378
1379
1380
1381
1382
1383
1384
1385
1386
1387
1388
1389
1390
1391
1392
1393
1394
1395
1396
1397
1398
1399
1400
1401
1402
1403
1404
1405
1406
1407
1408
1409
1410
1411
1412
1413
1414
1415
1416
1417
1418
1419
1420
1421
1422
1423
1424
1425
1426
1427
1428
1429
1430
1431
1432
1433
1434
1435
1436
1437
1438
1439
1440
1441
1442
1443
1444
1445
1446
1447
1448
1449
1450
1451
1452
1453
1454
1455
1456
1457
1458
1459
1460
1461
1462
1463
1464
1465
1466
1467
1468
1469
1470
1471
1472
1473
1474
1475
1476
1477
1478
1479
1480
1481
1482
1483
1484
1485
1486
1487
1488
1489
1490
1491
1492
1493
1494
1495
1496
1497
1498
1499
1500
1501
1502
1503
1504
1505
1506
1507
1508
1509
1510
1511
1512
1513
1514
1515
1516
1517
1518
1519
1520
1521
1522
1523
1524
1525
1526
1527
1528
1529
1530
1531
1532
1533
1534
1535
1536
1537
1538
1539
1540
1541
1542
1543
1544
1545
1546
1547
1548
1549
1550
1551
1552
1553
1554
1555
1556
1557
1558
1559
1560
1561
1562
1563
1564
1565
1566
1567
1568
1569
1570
1571
1572
1573
1574
1575
1576
1577
1578
1579
1580
1581
1582
1583
1584
1585
1586
1587
1588
1589
1590
1591
1592
1593
1594
1595
1596
1597
1598
1599
1600
1601
1602
1603
1604
1605
1606
1607
1608
1609
1610
1611
1612
1613
1614
1615
1616
1617
1618
1619
1620
1621
1622
1623
1624
1625
1626
1627
1628
1629
1630
1631
1632
1633
1634
1635
1636
1637
1638
1639
1640
1641
1642
1643
1644
1645
1646
1647
1648
1649
1650
1651
1652
1653
1654
1655
1656
1657
1658
1659
1660
1661
1662
1663
1664
1665
1666
1667
1668
1669
1670
1671
1672
1673
1674
1675
1676
1677
1678
1679
1680
1681
1682
1683
1684
1685
1686
1687
1688
1689
1690
1691
1692
1693
1694
1695
1696
1697
1698
1699
1700
1701
1702
1703
1704
1705
1706
1707
1708
1709
1710
1711
1712
1713
1714
1715
1716
1717
1718
1719
1720
1721
1722
1723
1724
1725
1726
1727
1728
1729
1730
1731
1732
1733
1734
1735
1736
1737
1738
1739
1740
1741
1742
1743
1744
1745
1746
1747
1748
1749
1750
1751
1752
1753
1754
1755
1756
1757
1758
1759
1760
1761
1762
1763
1764
1765
1766
1767
1768
1769
1770
1771
1772
1773
1774
1775
1776
1777
1778
1779
1780
1781
1782
1783
1784
1785
1786
1787
1788
1789
1790
1791
1792
1793
1794
1795
1796
1797
1798
1799
1800
1801
1802
1803
1804
1805
1806
1807
1808
1809
1810
1811
1812
1813
1814
1815
1816
1817
1818
1819
1820
1821
1822
1823
1824
1825
1826
1827
1828
1829
1830
1831
1832
1833
1834
1835
1836
1837
1838
1839
1840
1841
1842
1843
1844
1845
1846
1847
1848
1849
1850
1851
1852
1853
1854
1855
1856
1857
1858
1859
1860
1861
1862
1863
1864
1865
1866
1867
1868
1869
1870
1871
1872
1873
1874
1875
1876
1877
1878
1879
1880
1881
1882
1883
1884
1885
1886
1887
1888
1889
1890
1891
1892
1893
1894
1895
1896
1897
1898
1899
1900
1901
1902
1903
1904
1905
1906
1907
1908
1909
1910
1911
1912
1913
1914
1915
1916
1917
1918
1919
1920
1921
1922
1923
1924
1925
1926
1927
1928
1929
1930
1931
1932
1933
1934
1935
1936
1937
1938
1939
1940
1941
1942
1943
1944
1945
1946
1947
1948
1949
1950
1951
1952
1953
1954
1955
1956
1957
1958
1959
1960
1961
1962
1963
1964
1965
1966
1967
1968
1969
1970
1971
1972
1973
1974
1975
1976
1977
1978
1979
1980
1981
1982
1983
1984
1985
1986
1987
1988
1989
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
2026
2027
2028
2029
2030
2031
2032
2033
2034
2035
2036
2037
2038
2039
2040
2041
2042
2043
2044
2045
2046
2047
2048
2049
2050
2051
2052
2053
2054
2055
2056
2057
2058
2059
2060
2061
2062
2063
2064
2065
2066
2067
2068
2069
2070
2071
2072
2073
2074
2075
2076
2077
2078
2079
2080
2081
2082
2083
2084
2085
2086
2087
2088
2089
2090
2091
2092
2093
2094
2095
2096
2097
2098
2099
2100
2101
2102
2103
2104
2105
2106
2107
2108
2109
2110
2111
2112
2113
2114
2115
2116
2117
2118
2119
2120
2121
2122
2123
2124
2125
2126
2127
2128
2129
2130
2131
2132
2133
2134
2135
2136
2137
2138
2139
2140
2141
2142
2143
2144
2145
2146
2147
2148
2149
2150
2151
2152
2153
2154
2155
2156
2157
2158
2159
2160
2161
2162
2163
2164
2165
2166
2167
2168
2169
2170
2171
2172
2173
2174
2175
2176
2177
2178
2179
2180
2181
2182
2183
2184
2185
2186
2187
2188
2189
2190
2191
2192
2193
2194
2195
2196
2197
2198
2199

are substantially aligned with the cavities during use.

47. The system of claim 1, wherein the sensor array further comprises a cover layer coupled to the supporting member and a bottom layer coupled to the supporting member, wherein an opening is formed in the cover layer substantially aligned with the cavity, and wherein an opening is formed in the bottom layer substantially aligned with the cavity.

48. The system of claim 1, wherein the cavity is substantially tapered such that the width of the cavity narrows in a direction from a top surface of the supporting member toward a bottom surface of the supporting member, and wherein a minimum width of the cavity is substantially less than a width of the particle.

49. The system of claim 1, wherein a width of a bottom portion of the cavity is substantially less than a width of a top portion of the cavity, and wherein the width of the bottom portion of the cavity is substantially less than a width of the particle.

50. The system of claim 1, wherein the sensor array further comprises a cover layer coupled to the supporting member and a bottom layer coupled to the supporting member, wherein the bottom layer is configured to support the particle, and wherein an opening is formed in the cover layer substantially aligned with the cavity.

51. The system of claim 1, further comprising a removable cover layer.

52. The system of claim 1, wherein the supporting member comprises a plastic material.

53. The system of claim 1, wherein the supporting member comprises a silicon wafer.

54. The system of claim 1, wherein the supporting member comprises a dry film photoresist material.

55. The system of claim 1, wherein the supporting member comprises a plurality of layers of a dry film photoresist material.

5 56. The system of claim 1, wherein an inner surface of the cavity is coated with a reflective material.

10 57. The system of claim 1, further comprising channels in the supporting member, wherein the channels are configured to allow the fluid to flow through the channels into and away from the cavity.

5 58. The system of claim 1, wherein the sensor array further comprises a pump coupled to the supporting member, wherein the pump is configured to direct the fluid towards the cavity, and wherein a channel is formed in the supporting member, the channel coupling the pump to the cavity such that the fluid flows through the channel to the cavity during use.

20 59. The system of claim 1, wherein the sensor array further comprises a pump coupled to the supporting member, wherein the pump is configured to direct the fluid towards the cavity, and wherein a channel is formed in the supporting member, the channel coupling the pump to the cavity such that the fluid flows through the channel to the cavity during use, and wherein the pump comprises a diaphragm pump.

25 60. The system of claim 1, wherein the sensor array further comprises a pump coupled to the supporting member, wherein the pump is configured to direct the fluid towards the cavity, and wherein a channel is formed in the supporting member, the channel coupling the pump to the cavity such that the fluid flows through the channel to the cavity during use, and wherein the pump comprises a diaphragm pump, and wherein the pump comprises an electrode pump.

61. The system of claim 1 wherein the sensor array further comprises a pump coupled to the

supporting member, wherein the pump is configured to direct the fluid towards the cavity,
and wherein a channel is formed in the supporting member, the channel coupling the pump to
the cavity such that the fluid flows through the channel to the cavity during use, and wherein
the pump comprises a diaphragm pump, and wherein the pump comprises a piezoelectric
pump.

62. The system of claim 1, wherein the sensor array further comprises a pump coupled to the
supporting member, wherein the pump is configured to direct the fluid towards the cavity,
and wherein a channel is formed in the supporting member, the channel coupling the pump to
the cavity such that the fluid flows through the channel to the cavity during use, and wherein
the pump comprises a diaphragm pump, and wherein the pump comprises a pneumatic
activated pump.

63. The system of claim 1, wherein the sensor array further comprises a pump coupled to the
supporting member, wherein the pump is configured to direct the fluid towards the cavity,
and wherein a channel is formed in the supporting member, the channel coupling the pump to
the cavity such that the fluid flows through the channel to the cavity during use, and wherein
the pump comprises a diaphragm pump, and wherein the pump comprises a heat activated
pump.

64. The system of claim 1, wherein the sensor array further comprises a pump coupled to the
supporting member, wherein the pump is configured to direct the fluid towards the cavity,
and wherein a channel is formed in the supporting member, the channel coupling the pump to
the cavity such that the fluid flows through the channel to the cavity during use, and wherein
the pump comprises a diaphragm pump, and wherein the pump comprises a peristaltic pump.

65. The system of claim 1, wherein the sensor array further comprises a pump coupled to the
supporting member, wherein the pump is configured to direct the fluid towards the cavity,
and wherein a channel is formed in the supporting member, the channel coupling the pump to

the cavity such that the fluid flows through the channel to the cavity during use, and wherein the pump comprises a diaphragm pump, and wherein the pump comprises an electroosmosis pump.

5 66. The system of claim 1, wherein the sensor array further comprises a pump coupled to the supporting member, wherein the pump is configured to direct the fluid towards the cavity, and wherein a channel is formed in the supporting member, the channel coupling the pump to the cavity such that the fluid flows through the channel to the cavity during use, and wherein the pump comprises a diaphragm pump, and wherein the pump comprises an
10 electrohydrodynamic pump.

67. The system of claim 1, wherein the sensor array further comprises a pump coupled to the supporting member, wherein the pump is configured to direct the fluid towards the cavity, and wherein a channel is formed in the supporting member, the channel coupling the pump to the cavity such that the fluid flows through the channel to the cavity during use, and wherein the pump comprises a diaphragm pump, and wherein the pump comprises an electroosmosis pump and an electrohydrodynamic pump.

68. The system of claim 1, wherein the particle comprises a receptor molecule coupled to a polymeric resin, and wherein the particle further comprises a first indicator and a second indicator, the first and second indicators being coupled to the receptor, wherein the interaction of the receptor with the analyte causes the first and second indicators to interact such that the signal is produced.

25 69. The system of claim 1, wherein the particle comprises a receptor molecule coupled to a polymeric resin, and wherein the particle further comprises an indicator, wherein the indicator is associated with the receptor such that in the presence of the analyte the indicator is displaced from the receptor to produce the signal.

70. The system of claim 1, wherein a portion of the supporting member is substantially transparent to a portion of light produced by the light source.

71. The system of claim 1, wherein the particle is coupled to the supporting member with via an adhesive material.

72. The system of claim 1, wherein the particle are coupled to the supporting member via a gel material.

73. The system of claim 1, wherein the particle is suspended in a gel material, the gel material covering a portion of the supporting member, and wherein a portion of the particle extends from the upper surface of the gel.

74. The system of claim 1, wherein the sensor array further comprises a cover coupled to the supporting member, positioned above the particle, wherein a force exerted by the cover on the particle inhibits the displacement of the particle from the supporting member.

75. The system of claim 1, wherein the supporting member comprises glass.

76. The system of claim 1, wherein the supporting member is composed of a material substantially transparent to ultraviolet light.

77. The system of claim 1, further comprising a conduit coupled to the sensor array, wherein the conduit is configured to conduct the fluid sample to and away from the sensor array; and a vacuum chamber coupled to the conduit, wherein the vacuum chamber comprises a breakable barrier positioned between the chamber and the conduit, and wherein the chamber is configured to pull the fluid through the conduit when the breakable barrier is punctured.

78. The system of claim 1, further comprising a conduit coupled to the sensor array, wherein the

conduit is configured to conduct the fluid sample to and away from the sensor array; and a vacuum chamber coupled to the conduit, wherein the vacuum chamber comprises a breakable barrier positioned between the chamber and the conduit, and wherein the chamber is configured to pull the fluid through the conduit when the breakable barrier is punctured, and further comprising a filter coupled to the conduit and the sensor array, wherein the fluid passes through the filter before reaching the sensor array.

79. The system of claim 1, further comprising a conduit coupled to the sensor array, wherein the conduit is configured to conduct the fluid sample to and away from the sensor array; and a vacuum chamber coupled to the conduit, wherein the vacuum chamber comprises a breakable barrier positioned between the chamber and the conduit, and wherein the chamber is configured to pull the fluid through the conduit when the breakable barrier is punctured, and further comprising a filter coupled to the conduit and the sensor array, wherein the fluid passes through the filter before reaching the sensor array, and wherein the fluid is a blood sample, and wherein the filter comprises a membrane for the removal of particulates.

80. The system of claim 1, further comprising a conduit coupled to the sensor array, wherein the conduit is configured to conduct the fluid sample to and away from the sensor array; and a vacuum chamber coupled to the conduit, wherein the vacuum chamber comprises a breakable barrier positioned between the chamber and the conduit, and wherein the chamber is configured to pull the fluid through the conduit when the breakable barrier is punctured, and further comprising a filter coupled to the conduit and the sensor array, wherein the fluid passes through the filter before reaching the sensor array, and wherein the fluid is a blood sample, and wherein the filter comprises a membrane for removal of white and red blood cells from the blood.

81. The system of claim 1, wherein the particle comprises a biopolymer coupled to a polymeric resin, and wherein the biopolymer undergoes a chemical reaction in the presence of the analyte to produce a signal.

82. The system of claim 1, wherein the particle comprises a biopolymer coupled to a polymeric resin, and wherein the biopolymer undergoes a chemical reaction in the presence of the analyte to produce a signal, and wherein the chemical reaction comprises cleavage of the biopolymer by the analyte.

83. The system of claim 1, wherein the particle comprises a biopolymer coupled to a polymeric resin, and wherein the biopolymer undergoes a chemical reaction in the presence of the analyte to produce a signal, and wherein the biopolymer comprises a peptide, and wherein the analyte comprises a protease, and wherein the chemical reaction comprises cleavage of the peptide by the protease.

84. The system of claim 1, wherein the particle comprises a biopolymer coupled to a polymeric resin, and wherein the biopolymer undergoes a chemical reaction in the presence of the analyte to produce a signal, and wherein the biopolymer comprises a polynucleotide, and wherein the analyte comprises a nuclease, and wherein the chemical reaction comprises cleavage of the polynucleotide by the nuclease.

85. The system of claim 1, wherein the particle comprises a biopolymer coupled to a polymeric resin, and wherein the biopolymer undergoes a chemical reaction in the presence of the analyte to produce a signal, and wherein the biopolymer comprises an oligosaccharide, and wherein the analyte comprises an oligosaccharide cleaving agent, and wherein the chemical reaction comprises cleavage of the oligosaccharide by the oligosaccharide cleaving agent.

86. The system of claim 1, wherein the particle comprises a biopolymer coupled to a polymeric resin, and wherein the biopolymer undergoes a chemical reaction in the presence of the analyte to produce a signal, and wherein the particle further comprises a first indicator and a second indicator, the first and second indicators being coupled to the biopolymer, and wherein the chemical reaction of the biopolymer in the presence of the analyte causes a

distance between the first and second indicators to become altered such that the signal is produced.

5 87. The system of claim 1, wherein the particle comprises a biopolymer coupled to a polymeric resin, and wherein the biopolymer undergoes a chemical reaction in the presence of the analyte to produce a signal, and wherein the particle further comprises a first indicator and a second indicator, the first and second indicators being coupled to the biopolymer, and wherein the chemical reaction of the biopolymer in the presence of the analyte causes a distance between the first and second indicators to become altered such that the signal is produced, and wherein the first indicator is a fluorescent dye and wherein the second indicator is a fluorescent quencher, and wherein the first indicator and the second indicator are within the Föster energy transfer radius, and wherein the chemical reaction of the biopolymer in the presence of the analyte causes the first and second indicators to move outside the Föster energy transfer radius.

10 15 20 25 88. The system of claim 1, wherein the particle comprises a biopolymer coupled to a polymeric resin, and wherein the biopolymer undergoes a chemical reaction in the presence of the analyte to produce a signal, and wherein the particle further comprises a first indicator and a second indicator, the first and second indicators being coupled to the biopolymer, and wherein the chemical reaction of the biopolymer in the presence of the analyte causes a distance between the first and second indicators to become altered such that the signal is produced. wherein the first indicator is a fluorescent dye and wherein the second indicator is a different fluorescent dye, and wherein the first indicator and the second indicator produce a fluorescence resonance energy transfer signal, and wherein the chemical reaction of the biopolymer in the presence of the analyte causes the positions of the first and second indicators to change such that the fluorescence resonance energy transfer signal is altered.

89. The system of claim 1, wherein the particle comprises a biopolymer coupled to a polymeric resin, and wherein the biopolymer undergoes a chemical reaction in the presence of the

analyte to produce a signal, and further comprising an indicator coupled to the biopolymer, and wherein the chemical reaction of the biopolymer in the presence of the analyte causes the biopolymer to be cleaved such that a portion of the biopolymer coupled to the indicator is cleaved from a portion of the biopolymer coupled to the polymeric resin.

5

90. The system of claim 1 wherein the particle comprises a biopolymer coupled to a polymeric resin, and wherein the biopolymer undergoes a chemical reaction in the presence of the analyte to produce a signal, and wherein the particle further comprises an indicator coupled to the particle, and wherein the chemical reaction causes a change to a biopolymer such that the interaction of the indicator with the biopolymer is altered to produce the signal.

10

91. The system of claim 1, wherein the particle comprises a biopolymer coupled to a polymeric resin, and wherein the biopolymer undergoes a chemical reaction in the presence of the analyte to produce a signal, and wherein the particle further comprises an indicator coupled to the particle, and wherein the chemical reaction causes a change to the biopolymer and the indicator to produce the signal.

15

92. The system of claim 1, wherein the particle comprises a receptor coupled to a polymeric resin, and a probe molecule coupled to the polymeric resin, and wherein the probe molecule is configured to produce a signal when the receptor interacts with the analyte during use.

20

93. The system of claim 1, wherein the particle comprises a receptor coupled to a polymeric resin, and a probe molecule coupled to the polymeric resin, and wherein the probe molecule is configured to produce a signal when the receptor interacts with the analyte during use, and wherein the particles further comprises an additional probe molecule coupled to the polymeric resin, wherein the interaction of the receptor with the analyte causes the probe molecules to interact such that the signal is produced.

25

94. A system for detecting an analyte in a fluid comprising:

a light source;

a sensor array, the sensor array comprising:

5

a supporting member; wherein a first cavity and a second cavity are formed within the supporting member;

a first particle positioned within the first cavity;

10

a second particle positioned within the second cavity, wherein the second particle comprises a reagent, wherein a portion of the reagent is removable from the second particle when contacted with a decoupling solution, and wherein the reagent is configured to modify the first particle, when the reagent is contacted with the first particle, such that the first particle will produce a signal when the first particle interacts with the analyte during use;

15

a first pump coupled to the supporting member, wherein the pump is configured to direct the fluid towards the first cavity;

20

a second pump coupled to the supporting member, wherein the second pump is configured to direct the decoupling solution towards the second cavity;

wherein a first channel is formed in the supporting member, the first channel coupling the first pump to the first cavity such that the fluid flows through the first channel to the first cavity during use, and wherein a second channel is formed in the supporting member, the second channel coupling the second cavity to the first cavity such that the decoupling solution flows from the second cavity through the second channel to the first cavity during use; and

25

a detector, the detector being configured to detect the signal produced by the interaction of the analyte with the particle during use;

5 wherein the light source and detector are positioned such that light passes from the light source, to the particle, and onto the detector during use.

95. The system of claim 94, wherein the sensor array further comprises a plurality of additional particles positioned within a plurality of additional cavities, and wherein the system is
10 configured to substantially simultaneously detect a plurality of analytes in the fluid, and wherein the second cavity is coupled to the additional cavities such that the reagent may be transferred from the second particle to the additional cavities during use.

96. The system of claim 94, wherein the first particle comprises an indicator molecule coupled to
15 a first polymeric resin, and the second particle comprises a receptor molecule coupled to a second polymeric resin.

97. The system of claim 94, wherein the first particle comprises a first polymeric resin configured
20 to bind to the receptor molecule, and wherein the second particle comprises the receptor molecule coupled to a second polymeric resin.

98. The system of claim 94, wherein the sensor array further comprises a reservoir coupled to the second pump, the reservoir configured to hold the decoupling solution.

25 99. A system for detecting an analyte in a fluid comprising:

a light source;

a sensor array, the sensor array comprising at least one particle coupled to the sensor

array, wherein the particle is configured to produce a signal when the particle interacts with the analyte; and

a detector configured to detect the signal produced by the interaction of the analyte with the particle;

wherein the light source and detector are positioned such that light passes from the light source, to the particle, and onto the detector during use.

100. A sensor array for detecting an analyte in a fluid comprising:

a supporting member; wherein at least one cavity is formed within the supporting member;

a particle positioned within the cavity, wherein the particle is configured to produce a signal when the particle interacts with the analyte.

101. The sensor array of claim 100, further comprising a plurality of particles positioned within the cavity.

102. The sensor array of claim 100, wherein the particle comprises a receptor molecule coupled to a polymeric resin.

103. The sensor array of claim 100, wherein the particle has a size ranging from about 0.05 micron to about 500 microns in diameter.

104. The sensor array of claim 100, wherein the particle has a size ranging from about 0.05 micron to about 500 microns in diameter, and wherein the cavity is configured to substantially contain the particle.

105. The sensor array of claim 100, wherein the supporting member comprises a plastic material.

5 106. The sensor array of claim 100, wherein the supporting member comprises a silicon wafer.

107. The sensor array of claim 100, wherein the cavity extends through the supporting member.

10 108. The sensor array of claim 100, wherein the supporting member comprises a silicon wafer, and wherein the cavity is substantially pyramidal in shape and wherein the sidewalls of the cavity are substantially tapered at an angle of between about 50 to about 60 degrees.

15 109. The sensor array of claim 100, wherein the supporting member comprises a silicon wafer, and further comprising a substantially transparent layer positioned on a bottom surface of the silicon wafer.

20 110. The sensor array of claim 100, wherein the supporting member comprises a silicon wafer, and further comprising a substantially transparent layer positioned on a bottom surface of the silicon wafer, wherein the substantially transparent layer comprises silicon dioxide, silicon nitride, or silicon oxide/silicon nitride multilayer stacks.

25 111. The sensor array of claim 100, wherein the supporting member comprises a silicon wafer, and further comprising a substantially transparent layer positioned on a bottom surface of the silicon wafer, wherein the substantially transparent layer comprises silicon nitride.

112. The sensor array of claim 100, wherein the supporting member comprises a silicon wafer, and wherein the silicon wafer has an area of about 1 cm² to about 100 cm².

113. The sensor array of claim 100, further comprising a plurality of cavities formed in the silicon wafer, and wherein from about 10 to about 10^6 cavities are formed in the silicon wafer.

5 114. The sensor array of claim 100, further comprising channels in the supporting member, wherein the channels are configured to allow the fluid to flow through the channels into and away from the cavity.

10 115. The sensor array of claim 100, further comprising an inner surface coating, wherein the inner surface coating is configured to inhibit dislodgment of the particle.

116. The sensor array of claim 100, further comprising a detector coupled to the bottom surface of the supporting member, wherein the detector is positioned below the cavity.

15 117. The sensor array of claim 100, further comprising a detector coupled to the bottom surface of the supporting member, wherein the detector is positioned below the cavity, and wherein the detector is a semiconductor based photodetector.

20 118. The sensor array of claim 100, further comprising a detector coupled to the bottom surface of the supporting member, wherein the detector is positioned below the cavity, and wherein the detector is a Fabry-Perot type detector.

25 119. The sensor array of claim 100, further comprising a detector coupled to the bottom surface of the supporting member, wherein the detector is positioned below the cavity, and further comprising an optical fiber coupled to the detector, wherein the optical fiber is configured to transmit optical data to a microprocessor.

120. The sensor array of claim 100, further comprising an optical filters coupled to a bottom surface of the sensor array.

121. The sensor array of claim 100, further comprising a barrier layer positioned over the cavity, the barrier layer being configured to inhibit dislodgment of the particle during use.

5 122. The sensor array of claim 100, further comprising a barrier layer positioned over the cavity, the barrier layer being configured to inhibit dislodgment of the particle during use, and wherein the barrier layer comprises a substantially transparent cover plate positioned over the cavity, and wherein the cover plate is positioned a fixed distance over the cavity such that the fluid can enter the cavity.

10 123. The sensor array of claim 100, further comprising a barrier layer positioned over the cavity, the barrier layer being configured to inhibit dislodgment of the particle during use, and wherein the barrier layer comprises a substantially transparent cover plate positioned over the cavity, and wherein the cover plate is positioned a fixed distance over the cavity such that the fluid can enter the cavity, and wherein the barrier layer comprises plastic, glass, 15 quartz, silicon oxide, or silicon nitride.

20 124. The sensor array of claim 100, further comprising a plurality of particles positioned within a plurality of cavities formed in the supporting member.

125. The sensor array of claim 100, wherein the system comprises a plurality of particles positioned within a plurality of cavities, and wherein the plurality of particles produce a detectable pattern in the presence of the analyte.

25 126. The sensor array of claim 100, further comprising channels in the supporting member, wherein the channels are configured to allow the fluid to flow through the channels into and away from the cavities, and wherein the barrier layer comprises a cover plate positioned upon an upper surface of the supporting member, and wherein the cover plate inhibits passage of the fluid into the cavities such that the fluid enters the cavities via the channels.

127. The sensor array of claim 100, further comprising a cover layer coupled to the supporting member and a bottom layer coupled to the supporting member, wherein the bottom layer is coupled to a bottom surface of the supporting member and wherein the cover layer is removable, and wherein the cover layer and the bottom layer include openings that are substantially aligned with the cavities during use.

128. The sensor array of claim 100, further comprising a cover layer coupled to the supporting member and a bottom layer coupled to the supporting member, wherein an opening is formed in the cover layer substantially aligned with the cavity, and wherein an opening is formed in the bottom layer substantially aligned with the cavity.

129. The sensor array of claim 100, wherein the cavity is substantially tapered such that the width of the cavity narrows in a direction from a top surface of the supporting member toward a bottom surface of the supporting member, and wherein a minimum width of the cavity is substantially less than a width of the particle.

130. The sensor array of claim 100, wherein a width of a bottom portion of the cavity is substantially less than a width of a top portion of the cavity, and wherein the width of the bottom portion of the cavity is substantially less than a width of the particle.

131. The sensor array of claim 100, further comprising a cover layer coupled to the supporting member and a bottom layer coupled to the supporting member, wherein the bottom layer is configured to support the particle, and wherein an opening is formed in the cover layer substantially aligned with the cavity.

132. The sensor array of claim 100, further comprising a removable cover layer coupled to the supporting member.

133. The sensor array of claim 100, wherein the supporting member comprises a dry film photoresist material.

134. The sensor array of claim 100, wherein the supporting member comprises a plurality of layers of a dry film photoresist material.

135. The sensor array of claim 100, wherein an inner surface of the cavity is coated with a reflective material.

136. The sensor array of claim 100, further comprising channels in the supporting member, wherein the channels are configured to allow the fluid to flow through the channels into and away from the cavity.

137. The sensor array of claim 100, further comprising a pump coupled to the supporting member, wherein the pump is configured to direct the fluid towards the cavity; and a channel formed in the supporting member, the channel coupling the pump to the cavity such that the fluid flows through the channel to the cavity during use.

138. The sensor array of claim 100, further comprising a pump coupled to the supporting member, wherein the pump is configured to direct the fluid towards the cavity; and a channel formed in the supporting member, the channel coupling the pump to the cavity such that the fluid flows through the channel to the cavity during use, and wherein the pump comprises a diaphragm pump.

139. The sensor array of claim 100, further comprising a pump coupled to the supporting member, wherein the pump is configured to direct the fluid towards the cavity; and a channel formed in the supporting member, the channel coupling the pump to the cavity such that the fluid flows through the channel to the cavity during use, and wherein the pump comprises an electrode pump.

140. The sensor array of claim 100, further comprising a pump coupled to the supporting member, wherein the pump is configured to direct the fluid towards the cavity; and a channel formed in the supporting member, the channel coupling the pump to the cavity such that the fluid flows through the channel to the cavity during use, and wherein the pump comprises a piezoelectric pump.

141. The sensor array of claim 100, further comprising a pump coupled to the supporting member, wherein the pump is configured to direct the fluid towards the cavity; and a channel formed in the supporting member, the channel coupling the pump to the cavity such that the fluid flows through the channel to the cavity during use, and wherein the pump comprises a pneumatic activated pump.

142. The sensor array of claim 100, further comprising a pump coupled to the supporting member, wherein the pump is configured to direct the fluid towards the cavity; and a channel formed in the supporting member, the channel coupling the pump to the cavity such that the fluid flows through the channel to the cavity during use, and wherein the pump comprises a heat activated pump.

143. The sensor array of claim 100, further comprising a pump coupled to the supporting member, wherein the pump is configured to direct the fluid towards the cavity; and a channel formed in the supporting member, the channel coupling the pump to the cavity such that the fluid flows through the channel to the cavity during use, and wherein the pump comprises a peristaltic pump.

144. The sensor array of claim 100, further comprising a pump coupled to the supporting member, wherein the pump is configured to direct the fluid towards the cavity; and a channel formed in the supporting member, the channel coupling the pump to the cavity such that the

fluid flows through the channel to the cavity during use, and wherein the pump comprises an electroosmosis pump.

145. The sensor array of claim 100, further comprising a pump coupled to the supporting member, wherein the pump is configured to direct the fluid towards the cavity; and a channel formed in the supporting member, the channel coupling the pump to the cavity such that the fluid flows through the channel to the cavity during use, and wherein the pump comprises an electrohydrodynamic pump.

146. The sensor array of claim 100, further comprising a pump coupled to the supporting member, wherein the pump is configured to direct the fluid towards the cavity; and a channel formed in the supporting member, the channel coupling the pump to the cavity such that the fluid flows through the channel to the cavity during use, and wherein the pump comprises an electroosmosis pump and an electrohydrodynamic pump.

147. The sensor array of claim 100, wherein a width of a bottom portion of the cavity is substantially less than a width of a top portion of the cavity, and wherein the width of the bottom portion of the cavity is substantially less than a width of the particle.

148. A sensor array for detecting an analyte in a fluid comprising:

a supporting member; wherein a first cavity and a second cavity are formed within the supporting member;

a first particle positioned within the first cavity;

a second particle positioned within the second cavity, wherein the second particle comprises a reagent, wherein a portion of the reagent is removable from the second

particle when contacted with a decoupling solution, and wherein the reagent is configured to modify the first particle, when the reagent is contacted with the first particle, such that the first particle will produce a signal when the first particle interacts with the analyte during use;

5

a first pump coupled to the supporting member, wherein the pump is configured to direct the fluid towards the first cavity;

10

a second pump coupled to the supporting member, wherein the second pump is configured to direct the decoupling solution towards the second cavity;

wherein a first channel is formed in the supporting member, the first channel coupling the first pump to the first cavity such that the fluid flows through the first channel to the first cavity during use, and wherein a second channel is formed in the supporting member, the second channel coupling the second cavity to the first cavity such that the decoupling solution flows from the second cavity through the second channel to the first cavity during use.

149. The sensor array of claim 148, wherein the first particle comprises a receptor molecule coupled to a first polymeric resin, and wherein the second particle comprises an indicator molecule coupled to a second polymeric resin.

150. The sensor array of claim 148, wherein the first particle comprises an indicator molecule coupled to a first polymeric resin, and the second particle comprises a receptor molecule coupled to a second polymeric resin.

151. The sensor array of claim 148, wherein the first particle comprises a first polymeric resin configured to bind to the receptor molecule, and wherein the second particle comprises the receptor molecule coupled to a second polymeric resin.

152. The sensor array of claim 148, further comprising a reservoir coupled to the second pump, the reservoir configured to hold the decoupling solution.

5 153. A sensor array for detecting an analyte in a fluid comprising:

at least one particle coupled to a supporting member, wherein the particle is configured to produce a signal when the particle interacts with the analyte.

10 154. The sensor array of claim 153, wherein the particle is coupled to the supporting member with via an adhesive material.

15 155. The sensor array of claim 153, wherein the particle are coupled to the supporting member via a gel material.

20 156. The sensor array of claim 153, wherein the particle is suspended in a gel material, the gel material covering a portion of the supporting member, and wherein a portion of the particle extends from the upper surface of the gel.

25 157. The sensor array of claim 153, further comprising a cover positioned above the particle.

158. The sensor array of claim 153, further comprising a cover coupled to the supporting member, positioned above the particle, wherein a force exerted by the cover on the particle inhibits the displacement of the particle from the supporting member.

30 159. The sensor array of claim 153, wherein the particle comprises a receptor molecule coupled to a polymeric resin.

160. The sensor array of claim 153, wherein the supporting member comprises glass.

161. A method for forming a sensor array configured to detect an analyte in a fluid,
comprising:

5 forming a cavity in a supporting member, wherein the supporting member comprises a
silicon wafer;

placing a particle in the cavity, wherein the particle is configured to produce a signal
when the particle interacts with the analyte; and

10 forming a cover upon a portion of the supporting member, wherein the cover is
configured to inhibit dislodgment of the particle from the cavity.

162. The method of claim 161, wherein forming the cavity comprises anisotropically etching
the silicon wafer.

163. The method of claim 161, wherein forming the cavity comprises anisotropically etching
the silicon wafer with a wet hydroxide etch.

20 164. The method of claim 161, wherein forming the cavity comprises anisotropically etching
the silicon wafer such that sidewalls of the cavity are tapered at an angle from about 50
degrees to about 60 degrees.

25 165. The method of claim 161, wherein the silicon wafer has an area of about 1 cm² to about
100 cm².

166. The method of claim 161, further comprising forming a substantially transparent layer
upon a bottom surface of the silicon wafer below the cavity.

167. The method of claim 161, further comprising forming a substantially transparent layer upon a bottom surface of the silicon wafer, wherein the cavity extends through the silicon wafer and wherein the substantially transparent layer is positioned to support the particle.

5 168. The method of claim 161, wherein the substantially transparent layer comprises silicon nitride.

169. The method of claim 161, wherein the cover comprises plastic, glass, quartz, silicon nitride, or silicon oxide.

10

170. The method of claim 161, wherein forming the cover comprises coupling the cover to the silicon wafer at a distance above the silicon wafer substantially less than a width of the particle.

171. The method of claim 161, further comprising etching channels in the silicon wafer prior to forming the cover on the silicon wafer, wherein forming the cover comprises placing the cover against the upper surface of the silicon wafer, and wherein the channels are configured to allow the fluid to pass through the silicon wafer to and from the cavities.

172. The method of claim 161, further comprising coating an inner surface of the cavity with a material to increase adhesion of the particle to the inner surface of the cavity.

173. The method of claim 161, further comprising coating an inner surface of the cavity with a material to increase reflectivity of the inner surface of the cavity.

25

174. The method of claim 161, further comprising forming an optical detector upon a bottom surface of the supporting member below the cavity.

175. The method of claim 161, further comprising forming a sensing cavity upon a bottom

surface of the supporting member below the cavity.

176. The method of claim 161, further comprising forming a sensing cavity upon a bottom surface of the supporting member below the cavity, and wherein forming the sensing cavity comprises:

forming a barrier layer upon a bottom surface of the silicon wafer;

forming a bottom diaphragm layer upon the barrier layer;

forming etch windows extending through the bottom diaphragm layer;

forming a sacrificial spacer layer upon the bottom diaphragm layer;

removing a portion of the spacer layer;

forming a top diaphragm layer; and

removing a remaining portion of the spacer layer.

177. The method of claim 161, further comprising forming an optical filter upon the bottom surface of the supporting member.

178. The method of claim 161, further comprising forming a plurality of cavities in the silicon wafer.

179. The method of claim 161, wherein from about 10 to about 10^6 cavities are formed in the silicon wafer.

180. The method of claim 161, wherein the formed cavity is configured to allow the fluid to pass through the supporting member.

181. The method of claim 161, further comprising forming a substantially transparent layer upon a bottom surface of the supporting member below the cavity, wherein the bottom layer is configured to inhibit the displacement of the particle from the cavity while allowing the fluid to pass through the supporting member.

182. The system of claim 161, wherein a width of a bottom portion of the cavity is substantially less than a width of a top portion of the cavity, and wherein the width of the bottom portion of the cavity is substantially less than a width of the particle.

183. The method of claim 161, further comprising forming channels in the supporting member wherein the channels are configured to allow the fluid to pass through the supporting member to and from the cavity.

184. The method of claim 161, further comprising forming a pump on the supporting member, the pump being configured to pump the fluid to the cavity.

185. The method of claim 161, further comprising forming a cover, wherein forming the cover comprises:

forming a removable layer upon the upper surface of the supporting member;

forming a cover upon the removable layer;

forming support structures upon the supporting member, the support structures covering a portion of the cover; and

dissolving the removable layer.

186. The method of claim 161, wherein forming the cover further comprises forming openings in the cover, wherein the openings are substantially aligned with the cavity.

5

187. The method of claim 161, wherein the particles are placed in the cavities using a micromanipulator.

10

188. The method of claim 161, further comprising forming additional cavities within the supporting member, and further comprising placing additional particles in the additional cavities, wherein placing the additional particles in the additional cavities comprises:

placing a first masking layer on the supporting member, wherein the first masking layer covers a first portion of the additional cavities such that passage of a particle into the first portion of the additional cavities is inhibited, and wherein the first masking layer a second portion of the cavities substantially unmasked;

placing the additional particles on the supporting member;

moving the additional particles across the supporting member such that the particles fall into the second portion of the cavities;

removing the first masking layer;

25

placing a second masking layer upon the supporting member, wherein the second masking layer covers the second portion of the cavities and a portion of the first portion of the cavities while leaving a third portion of the cavities unmasked;

placing additional particles on the supporting member; and

moving the additional particles across the supporting member such that the particle fall into the third portion of the cavities.

5 189. The method of claim 161, wherein forming the cover comprises coupling the cover to the supporting member at a distance above the supporting member substantially less than a width of the particle.

10 190. The method of claim 161, wherein the supporting member comprises a dry film photoresist material.

15 191. The method of claim 161, wherein the supporting member comprises a plurality of layers of a dry film photoresist material.

20 192. The method of claim 161, wherein forming the cavity comprises:

etching a first opening through a first dry film photoresist layer, the first opening having a width substantially less than a width of the particle;

25 placing a second dry film photoresist layer upon the first dry film photoresist layer;

etching a second opening through the second dry film photoresist layer, the second opening being substantially aligned with the first opening, wherein a width of the second opening is substantially greater than the width of the first opening;

30 wherein the second dry film photoresist layer comprises a thickness substantially greater than a width of the particle;

and further comprising forming a reflective layer upon the inner surface of the cavity.

193. The method of claim 161, wherein the supporting material comprises a plastic material.

194. The method of claim 161, wherein the supporting material comprises a plastic material,
5 and wherein the cavity is formed by drilling the supporting material.

195. The method of claim 161, wherein the supporting material comprises a plastic material,
and wherein the cavity is formed by transfer molding the supporting member.

10 196. The method of claim 161, wherein the supporting material comprises a plastic material,
and wherein the cavity is formed by a punching device.

197. A method of sensing an analyte in a fluid comprising:

passing a fluid over a sensor array, the sensor array comprising at least one particle
positioned within a cavity of a supporting member;

monitoring a spectroscopic change of the particle as the fluid is passed over the sensor
array, wherein the spectroscopic change is caused by the interaction of the analyte
with the particle.

198. The method of claim 197, wherein the spectroscopic change comprises a change in
absorbance of the particle.

25 199. The method of claim 197, wherein the spectroscopic change comprises a change in
fluorescence of the particle.

200. The method of claim 197, wherein the spectroscopic change comprises a change in
phosphorescence of the particle.

201. The method of claim 197, wherein the analyte is a proton atom, and wherein the spectroscopic change is produced when the pH of the fluid is varied, and wherein monitoring the spectroscopic change of the particle allows the pH of the fluid to be determined.

5

202. The method of claim 197, wherein the analyte is a metal cation, and wherein the spectroscopic change is produced in response to the presence of the metal cation in the fluid.

10

203. The method of claim 197, wherein the analyte is an anion, and wherein the spectroscopic change is produced in response to the presence of the anion in the fluid.

204. The method of claim 197, wherein the analyte is a DNA molecule, and wherein the spectroscopic change is produced in response to the presence of the DNA molecule in the fluid.

205. The method of claim 197, wherein the analyte is a protein, and wherein the spectroscopic change is produced in response to the presence of the protein in the fluid.

206. The method of claim 197, wherein the analyte is a metabolite, and wherein the spectroscopic change is produced in response to the presence of the metabolite in the fluid.

207. The method of claim 197, wherein the analyte is a sugar, and wherein the spectroscopic change is produced in response to the presence of the sugar in the fluid.

208. The method of claim 197, wherein the analyte is a bacteria, and wherein the spectroscopic change is produced in response to the presence of the bacteria in the fluid.

209. The method of claim 197, wherein the particle comprises a receptor coupled to a polymeric resin, and further comprising exposing the particle to an indicator prior to passing

the fluid over the sensor array.

210. The method of claim 197, wherein the particle comprises a receptor coupled to a
polymeric resin, and further comprising exposing the particle to an indicator prior to passing
5 the fluid over the sensor array, and wherein a binding strength of the indicator to the receptor
is less than a binding strength of the analyte to the receptor.

211. The method of claim 197, wherein the particle comprises a receptor coupled to a
polymeric resin, and further comprising exposing the particle to an indicator prior to passing
10 the fluid over the sensor array, and wherein the indicator is a fluorescent indicator.

212. The method of claim 197, further comprising treating the fluid with an indicator prior to
passing the fluid over the sensor array, wherein the indicator is configured to couple with the
analyte.

213. The method of claim 197, wherein the analyte is bacteria and further comprising breaking
down the bacteria prior to passing the fluid over the sensor array.

214. The method of claim 197, wherein monitoring the spectroscopic change is performed
with a CCD device.

215. The method of claim 197, further comprising measuring the intensity of the spectroscopic
change, and further comprising calculating the concentration of the analyte based on the
intensity of the spectroscopic change.

216. The method of claim 197, wherein the supporting member comprises silicon.

217. The method of claim 197, wherein the spectroscopic change comprises a change in
reflectance of the particle.

218. The method of claim 197, wherein the cavity is configured such that the fluid entering the cavity passes through the supporting member.

5 219. The method of claim 197, wherein monitoring the spectroscopic change comprises:

directing a red light source at the particle;

detecting the absorbance of red light by the particle;

directing a green light source at the particle;

detecting the absorbance of green light by the particle;

directing a blue light source at the particle; and

detecting the absorbance of blue light by the particle.

220. The method of claim 197, wherein the sensor array further comprises a vacuum chamber coupled to a conduit and the sensor array , and wherein the chamber is configured to provide a pulling force on the fluid in the sensor array.

221. The method of claim 197, wherein the fluid is blood.

222. The method of claim 197, further comprising passing the fluid through a filter prior to passing the fluid over the sensor array.

223. The method of claim 197, further comprising passing the fluid through a reagent reservoir prior to passing the fluid over the sensor array.

224. The method of claim 197, wherein the particles are initially stored in a buffer, and further comprising removing the buffer prior to passing the fluid over the sensor array.

5 225. The method of claim 197, wherein the particle comprises a polymeric resin, a biopolymer coupled to the polymeric resin, and wherein the biopolymer undergoes a chemical reaction in the presence of the analyte to produce a signal.

10 226. The method of claim 197, wherein the particle comprises a polymeric resin, a biopolymer coupled to the polymeric resin, and wherein the biopolymer undergoes a chemical reaction in the presence of the analyte to produce a signal, and wherein the signal comprises an absorbance of the particle.

15 227. The method of claim 197, wherein the particle comprises a polymeric resin, a biopolymer coupled to the polymeric resin, and wherein the biopolymer undergoes a chemical reaction in the presence of the analyte to produce a signal, and wherein the signal comprises a fluorescence of the particle.

20 228. The method of claim 197, wherein the particle comprises a polymeric resin, a biopolymer coupled to the polymeric resin, and wherein the biopolymer undergoes a chemical reaction in the presence of the analyte to produce a signal, and wherein the signal comprises a phosphorescence of the particle.

25 229. The method of claim 197, wherein the particle comprises a polymeric resin, a biopolymer coupled to the polymeric resin, and wherein the biopolymer undergoes a chemical reaction in the presence of the analyte to produce a signal, and wherein the chemical reaction comprises cleavage of the biopolymer induced by the analyte.

230. The method of claim 197, wherein the particle comprises a polymeric resin, a biopolymer

coupled to the polymeric resin, and wherein the biopolymer undergoes a chemical reaction in the presence of the analyte to produce a signal, and wherein the biopolymer comprises a peptide, and wherein the analyte comprises a protease, and wherein the chemical reaction comprises cleavage of the peptide by the protease.

5

231. The method of claim 197, wherein the particle comprises a polymeric resin, a biopolymer coupled to the polymeric resin, and wherein the biopolymer undergoes a chemical reaction in the presence of the analyte to produce a signal, and wherein the biopolymer comprises a polynucleotide, and wherein the analyte comprises a nuclease, and wherein the chemical
10 reaction comprises cleavage of the polynucleotide by the nuclease.

232. The method of claim 197, wherein the particle comprises a polymeric resin, a biopolymer coupled to the polymeric resin, and wherein the biopolymer undergoes a chemical reaction in the presence of the analyte to produce a signal, and wherein the biopolymer comprises an oligosaccharide, and wherein the analyte comprises an oligosaccharide cleaving agent, and wherein the chemical reaction comprises cleavage of the oligosaccharide by the
15 oligosaccharide cleaving agent.

233. The method of claim 197, wherein the particle comprises a polymeric resin, a biopolymer coupled to the polymeric resin, and wherein the biopolymer undergoes a chemical reaction in the presence of the analyte to produce a signal, and wherein the particle further comprises a first indicator and a second indicator, the first and second indicators being coupled to the biopolymer, and wherein the chemical reaction of the biopolymer in the presence of the
20 analyte causes a distance between the first and second indicators to become altered such that the alteration of the signal is produced.

234. The method of claim 197, wherein the particle comprises a polymeric resin, a biopolymer coupled to the polymeric resin, and wherein the biopolymer undergoes a chemical reaction in the presence of the analyte to produce a signal, and wherein the particle further comprises a

first indicator and a second indicator, the first and second indicators being coupled to the biopolymer, and wherein the chemical reaction of the biopolymer in the presence of the analyte causes a distance between the first and second indicators to become altered such that the alteration of the signal is produced, and wherein the first indicator is a fluorescent dye and wherein the second indicator is a fluorescent quencher, and wherein the first indicator and the second indicator are within the Förster energy transfer radius, and wherein the chemical reaction of the biopolymer in the presence of the analyte causes the first and second indicators to move outside the Förster energy transfer radius such that the alteration of the signal is produced.

235. The method of claim 197, wherein the particle comprises a polymeric resin, a biopolymer coupled to the polymeric resin, and wherein the biopolymer undergoes a chemical reaction in the presence of the analyte to produce a signal, and wherein the particle further comprises a first indicator and a second indicator, the first and second indicators being coupled to the biopolymer, and wherein the chemical reaction of the biopolymer in the presence of the analyte causes a distance between the first and second indicators to become altered such that the alteration of the signal is produced, and wherein the first indicator is a fluorescent dye and wherein the second indicator is a different fluorescent dye, and wherein the first indicator and the second indicator produce a fluorescence resonance energy transfer signal, and wherein the chemical reaction of the biopolymer in the presence of the analyte causes the positions of the first and second indicators to change such that the fluorescence resonance energy transfer signal is altered producing the alteration in the signal.

236. The method of claim 197, wherein the particle comprises a polymeric resin, a biopolymer coupled to the polymeric resin, and wherein the biopolymer undergoes a chemical reaction in the presence of the analyte to produce a signal, and further comprising an indicator coupled to the biopolymer, and wherein the chemical reaction of the biopolymer in the presence of the analyte causes the biopolymer to be cleaved such that a portion of the biopolymer coupled to the indicator is cleaved from a portion of the biopolymer coupled to the polymeric resin.

237. The method of claim 197, wherein the particle comprises a receptor coupled to a polymeric resin, and a probe molecule coupled to the polymeric resin, and wherein the probe molecule is configured to produce a signal when the receptor interacts with the analyte during use.

238. The method of claim 197, wherein the particle comprises a receptor and an indicator coupled to a polymeric resin, wherein the indicator is configured to produce a signal when the receptor interacts with the analyte during use.

239. The method of claim 197, wherein the particle comprises a receptor and an indicator coupled to a polymeric resin, wherein the indicator is configured to produce a signal when the receptor interacts with the analyte during use, and wherein the receptor is coupled to the polymeric resin by a first linker and wherein the indicator is coupled to the polymeric resin by a second linker.

240. The method of claim 197, wherein the particle comprises a receptor and an indicator coupled to a polymeric resin, wherein the indicator is configured to produce a signal when the receptor interacts with the analyte during use, and wherein the receptor is coupled to the polymeric resin by a first linker and wherein the indicator is coupled to the polymeric resin by a second linker, and wherein the particle further comprises an additional indicator coupled to the polymeric resin by a third linker, wherein the interaction of the receptor with the analyte causes the indicator and the additional indicator to interact such that the signal is produced.

241. The method of claim 197, wherein the particle comprises a receptor and an indicator coupled to a polymeric resin, wherein the indicator is configured to produce a signal when the receptor interacts with the analyte during use, and wherein the receptor is coupled to the polymeric resin by a first linker and wherein the indicator is coupled to the receptor.

242. The method of claim 197, wherein the particle comprises a receptor and an indicator coupled to a polymeric resin, wherein the indicator is configured to produce a signal when the receptor interacts with the analyte during use, and wherein the receptor is coupled to the polymeric resin by a first linker and wherein the indicator is coupled to the receptor, and
5 wherein the particle further comprises an additional indicator coupled to the receptor, wherein the interaction of the receptor with the analyte causes the indicator and the additional indicator to interact such that the signal is produced.

243. The method of claim 197, wherein the particle comprises a receptor and an indicator
10 coupled to a polymeric resin, wherein the indicator is configured to produce a signal when the receptor interacts with the analyte during use, and wherein the receptor is coupled to the polymeric resin by a first linker and wherein the indicator is coupled to the receptor by a second linker.

244. The method of claim 197, wherein the particle comprises a receptor and an indicator
15 coupled to a polymeric resin, wherein the indicator is configured to produce a signal when the receptor interacts with the analyte during use, and wherein the receptor is coupled to the polymeric resin by a first linker and wherein the indicator is coupled to the receptor by a second linker, and wherein the particle further comprises an additional indicator coupled to
20 the receptor, wherein the interaction of the receptor with the analyte causes the indicator and the additional indicator to interact such that the signal is produced.

245. The method of claim 197, wherein the particle comprises a receptor and an indicator
25 coupled to a polymeric resin, wherein the indicator is configured to produce a signal when the receptor interacts with the analyte during use, and wherein the receptor is coupled to the polymeric resin by a first linker and wherein the indicator is coupled to the first linker.

246. The method of claim 197, wherein the particle comprises a receptor and an indicator coupled to a polymeric resin, wherein the indicator is configured to produce a signal when the

receptor interacts with the analyte during use, and wherein the receptor is coupled to the polymeric resin by a first linker, and wherein the indicator is coupled to the first linker by a second linker.

247. The method of claim 197, wherein the particle comprises a receptor and an indicator coupled to a polymeric resin, wherein the indicator is configured to produce a signal when the receptor interacts with the analyte during use, and wherein the receptor is coupled to the polymeric resin by a first linker, and wherein the indicator is coupled to the first linker by a second linker, and wherein the particle further comprises an additional indicator coupled to the receptor, wherein the interaction of the receptor with the analyte causes the indicator and the additional indicator to interact such that the signal is produced.

248. The method of claim 197, wherein the particle comprises a receptor and an indicator coupled to a polymeric resin, wherein the indicator is configured to produce a signal when the receptor interacts with the analyte during use, and wherein the receptor is coupled to the polymeric resin by a first linker, and wherein the indicator is coupled to the first linker by a second linker, and wherein the particle further comprises an additional indicator coupled to the first linker by a third linker, wherein the interaction of the receptor with the analyte causes the indicator and the additional indicator to interact such that the signal is produced.

249. The method of claim 197, wherein the particle comprises a receptor and an indicator coupled to a polymeric resin, wherein the indicator is configured to produce a signal when the receptor interacts with the analyte during use, and wherein the indicator interacts with the receptor in the absence of an analyte.

250. The method of claim 197, wherein the particle comprises a receptor and an indicator coupled to a polymeric resin, wherein the indicator is configured to produce a signal when the receptor interacts with the analyte during use, and wherein the particle further comprises an additional indicator coupled to the polymeric resin, and wherein the indicator is a first

fluorescent dye and wherein the additional indicator is a second fluorescent dye, and wherein the indicator and the additional indicator produce a fluorescence resonance energy transfer signal, and wherein the interaction of the analyte with the receptor causes the distance between the indicator and the additional indicator to become altered such that the fluorescence resonance energy transfer signal is altered.

251. The method of claim 197, wherein the particle comprises a receptor and an indicator coupled to a polymeric resin, wherein the indicator is configured to produce a signal when the receptor interacts with the analyte during use, and wherein the particle further comprises an additional indicator coupled to the polymeric resin, wherein the indicator is a fluorescent dye and wherein the additional indicator is a fluorescence quencher, and wherein the indicator and the additional indicator are positioned such that the fluorescence of the indicator is at least partially quenched by the additional indicator, and wherein the interaction of the analyte with the receptor causes the distance between the indicator and the additional indicator to become altered such that the quenching of the fluorescence of the indicator by the additional indicator is altered.

252. The method of claim 197, wherein the particle comprises a biopolymer coupled to a polymeric resin, and wherein the biopolymer undergoes a chemical reaction in the presence of the analyte to produce a signal, and wherein the biopolymer undergoes a chemical reaction in the presence of the analyte such that the signal is altered.

253. A particle for detecting an analyte in a fluid comprising:

a polymeric resin;

a biopolymer coupled to the polymeric resin; and

an indicator system coupled to the biopolymer, the indicator system producing a

signal, and wherein the biopolymer undergoes a chemical reaction in the presence of the analyte such that the signal is altered.

254. The particle of claim 253, wherein the particle ranges from about 0.05 micron to about 500 microns.

255. The particle of claim 253, wherein a volume of the particle changes when contacted with the fluid.

256. The particle of claim 253, wherein the chemical reaction comprises cleavage of the biopolymer by the analyte.

257. The particle of claim 253, wherein the biopolymer comprises a peptide, and wherein the analyte comprises a protease, and wherein the chemical reaction comprises cleavage of the peptide by the protease.

258. The particle of claim 253, wherein the biopolymer comprises a polynucleotide, and wherein the analyte comprises a nuclease, and wherein the chemical reaction comprises cleavage of the polynucleotide by the nuclease.

259. The particle of claim 253, wherein the biopolymer comprises an oligosaccharide, and wherein the analyte comprises an oligosaccharide cleaving agent, and wherein the chemical reaction comprises cleavage of the oligosaccharide by the oligosaccharide cleaving agent.

260. The particle of claim 253, wherein the particle indicator system comprises a first indicator and a second indicator, and wherein the chemical reaction of the biopolymer in the presence of the analyte causes a distance between the first and second indicators to become altered such that the signal is produced.

261. The particle of claim 253, wherein the first indicator is a fluorescent dye and wherein the second indicator is a fluorescent quencher, and wherein the first indicator and the second indicator are within the Föster energy transfer radius, and wherein the chemical reaction of the biopolymer in the presence of the analyte causes the first and second indicators to move outside the Föster energy transfer radius.

262. The particle of claim 253, wherein the first indicator is a fluorescent dye and wherein the second indicator is a different fluorescent dye, and wherein the first indicator and the second indicator produce a fluorescence resonance energy transfer signal, and wherein the chemical reaction of the biopolymer in the presence of the analyte causes the positions of the first and second indicators to change such that the fluorescence resonance energy transfer signal is altered.

263. The particle of claim 253, wherein the indicator system comprises at least one indicator coupled to the biopolymer, and wherein the chemical reaction of the biopolymer in the presence of the analyte causes the biopolymer to be cleaved such that a portion of the biopolymer coupled to the indicator is cleaved from a portion of the biopolymer coupled to the polymeric resin.

264. A particle for detecting an analyte in a fluid comprising:

a polymeric resin;

a receptor coupled to the polymeric resin; and

a probe molecule coupled to the biopolymer, the probe molecule configured to produce a signal when the receptor interacts with the analyte during use.

265. The particle of claim 264, wherein the analyte comprises a metal ion, and wherein the

probe molecule produces the signal in response to the interaction of the metal ion with the receptor.

266. The particle of claim 264, wherein the particles further comprises an additional probe molecule coupled to the polymeric resin, wherein the interaction of the receptor with the analyte causes the probe molecules to interact such that the signal is produced.

267. The particle of claim 264, wherein the receptor comprises a polynucleotide.

268. The particle of claim 264, wherein the receptor comprises a peptide.

269. The particle of claim 264, wherein the receptor comprises an enzyme.

270. The particle of claim 264, wherein the receptor comprises a synthetic receptor.

271. The particle of claim 264, wherein the receptor comprises an unnatural biopolymer.

272. The particle of claim 264, wherein the receptor comprises an antibody.

273. The particle of claim 264, wherein the receptor comprises an antigen.

274. The particle of claim 264, wherein the analyte comprises phosphate functional groups, and wherein the particle is configured to produce the signal in the presence of the phosphate functional groups.

275. The particle of claim 264, wherein the analyte comprises bacteria, and wherein the particle is configured to produce the signal in the presence of the bacteria.

276. The particle of claim 264, wherein the receptor comprises an antibody, an aptamer, an

organic receptor, or an enzyme.

277. The particle of claim 264, wherein the probe molecule comprises an indicator, a dye, a quantum particle, or a semi-conductor particle.

5

278. A particle for detecting an analyte in a fluid comprising:

a polymeric resin;

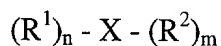
10 a receptor coupled to the polymeric resin by a first linker; and

an indicator coupled to the first linker, the indicator configured to produce a signal when the receptor interacts with the analyte during use.

15 279. The particle of claim 278, wherein the receptor comprises a polynucleotide.

20 280. The particle of claim 278, wherein the receptor comprises a peptide.

25 281. The particle of claim 278, wherein the receptor comprises a compound of the general formula:



25 wherein X comprises carbocyclic systems or C₁-C₁₀ alkanes, n is an integer of at least 1, m is an integer of at least 1; and

wherein each of R¹ independently represents -(CH₂)_y-NR³-C(NR⁴)-NR⁵, -(CH₂)_y-NR⁶R⁷, -(CH₂)_y-NH-Y, -(CH₂)_y-O-Z;

where y is an integer of at least 1;

where R³, R⁴, and R⁵ independently represent hydrogen, alkyl, aryl, alkyl carbonyl of 1 to 10 carbon atoms, or alkoxy carbonyl of 1 to 10 carbon atoms, or R⁴ and R⁵ together represent a cycloalkyl group;

where R⁶ represents hydrogen, alkyl, aryl, alkyl carbonyl of 1 to 10 carbon atoms, or alkoxy carbonyl of 1 to 10 carbon atoms;

where R⁷ represents alkyl, aryl, alkyl carbonyl of 1 to 10 carbon atoms, or alkoxy carbonyl of 1 to 10 carbon atoms;

where R⁶ and R⁷ together represent a cycloalkyl group;

where Y is a peptide, or hydrogen

and where Z is a polynucleotide, an oligosaccharide or hydrogen; and

wherein each of R² independently represents hydrogen, alkyl, alkenyl, alkynyl, phenyl, phenylalkyl, arylalkyl, aryl, or together with another R² group represent a carbocyclic ring.

282. The particle of claim 278, wherein the receptor comprises an enzyme.

283. The particle of claim 278, wherein the receptor is coupled to the first linker by a second linker and wherein the indicator is coupled to the first linker by a third linker.

284. The particle of claim 278, wherein the receptor is coupled to the first linker by a second linker and wherein the indicator is coupled to the first linker by a third linker, and wherein the indicator interacts with the receptor in the absence of an analyte.

285. The particle of claim 278, wherein the particle further comprises an additional indicator coupled to the first linker, wherein the interaction of the receptor with the analyte causes the indicator and the additional indicator to interact such that the signal is produced.

286. The particle of claim 278, wherein the particle further comprises an additional indicator

coupled to the receptor, wherein the interaction of the receptor with the analyte causes the indicator and the additional indicator to interact such that the signal is produced.

287. The particle of claim 278, wherein the particle further comprises an additional indicator
5 coupled to the first linker, and wherein the indicator is a first fluorescent dye and wherein the
additional indicator is a second fluorescent dye, and wherein the indicator and the additional
indicator produce a fluorescence resonance energy transfer signal, and wherein the interaction
of the analyte with the receptor causes the distance between the indicator and the additional
10 indicator to become altered such that the fluorescence resonance energy transfer signal is
altered.

288. The particle of claim 278, wherein the particle further comprises an additional indicator
coupled to the first linker, wherein the indicator is a fluorescent dye and wherein the
additional indicator is a fluorescence quencher, and wherein the indicator and the additional
15 indicator are positioned such that the fluorescence of the indicator is at least partially
quenched by the additional indicator, and wherein the interaction of the analyte with the
receptor causes the distance between the indicator and the additional indicator to become
altered such that the quenching of the fluorescence of the indicator by the additional indicator
is altered.

289. The particle of claim 278, wherein the particle further comprises an additional indicator
coupled to the first linker, wherein the indicator is a fluorescence quencher and wherein the
additional indicator is a fluorescent dye, and wherein the indicator and the additional
20 indicator are positioned such that the fluorescence of the additional indicator is at least
partially quenched by the indicator, and wherein the interaction of the analyte with the
receptor causes the distance between the indicator and the additional indicator to become
altered such that the quenching of the fluorescence of the additional indicator by the indicator
is altered.

290. The particle of claim 278, wherein the particle further comprises an additional indicator coupled to the receptor, and wherein the indicator is a first fluorescent dye and wherein the additional indicator is a second fluorescent dye, and wherein the indicator and the additional indicator produce a fluorescence resonance energy transfer signal, and wherein the interaction of the analyte with the receptor causes the distance between the indicator and the additional indicator to become altered such that the fluorescence resonance energy transfer signal is altered.

291. The particle of claim 278, wherein the particle further comprises an additional indicator coupled to the receptor, wherein the indicator is a fluorescent dye and wherein the additional indicator is a fluorescence quencher, and wherein the indicator and the additional indicator are positioned such that the fluorescence of the indicator is at least partially quenched by the additional indicator, and wherein the interaction of the analyte with the receptor causes the distance between the indicator and the additional indicator to become altered such that the quenching of the fluorescence of the indicator by the additional indicator is altered.

292. The particle of claim 278, wherein the particle further comprises an additional indicator coupled to the receptor, wherein the indicator is a fluorescence quencher and wherein the additional indicator is a fluorescent dye, and wherein the indicator and the additional indicator are positioned such that the fluorescence of the additional indicator is at least partially quenched by the indicator, and wherein the interaction of the analyte with the receptor causes the distance between the indicator and the additional indicator to become altered such that the quenching of the fluorescence of the additional indicator by the indicator is altered.

293. The particle of claim 278, wherein the particle further comprises an additional indicator coupled to the first linker, wherein the receptor is coupled to the first linker by a second linker, the indicator is coupled to the first linker by a third linker and the additional indicator is coupled to the first linker by a fourth linker, and wherein the indicator is a first fluorescent

dye and wherein the additional indicator is a second fluorescent dye, and wherein the indicator and the additional indicator produce a fluorescence resonance energy transfer signal, and wherein the interaction of the analyte with the receptor causes the distance between the indicator and the additional indicator to become altered such that the fluorescence resonance energy transfer signal is altered.

294. The particle of claim 278, wherein the particle further comprises an additional indicator coupled to the first linker, wherein the receptor is coupled to the first linker by a second linker, the indicator is coupled to the first linker by a third linker and the additional indicator is coupled to the first linker by a fourth linker, wherein the indicator is a fluorescent dye and wherein the additional indicator is a fluorescence quencher, and wherein the indicator and the additional indicator are positioned such that the fluorescence of the indicator is at least partially quenched by the additional indicator, and wherein the interaction of the analyte with the receptor causes the distance between the indicator and the additional indicator to become altered such that the quenching of the fluorescence of the indicator by the additional indicator is altered.

295. The particle of claim 278, wherein the particle further comprises an additional indicator coupled to the first linker, wherein the receptor is coupled to the first linker by a second linker, the indicator is coupled to the first linker by a third linker and the additional indicator is coupled to the first linker by a fourth linker, wherein the indicator is a fluorescence quencher and wherein the additional indicator is a fluorescent dye, and wherein the indicator and the additional indicator are positioned such that the fluorescence of the additional indicator is at least partially quenched by the indicator, and wherein the interaction of the analyte with the receptor causes the distance between the indicator and the additional indicator to become altered such that the quenching of the fluorescence of the additional indicator by the indicator is altered.

296. The particle of claim 278, wherein the particle further comprises an additional indicator

coupled to the receptor, wherein the receptor is coupled to the first linker by a second linker, the indicator is coupled to the first linker by a third linker and the additional indicator is coupled to the receptor by a fourth linker, and wherein the indicator is a first fluorescent dye and wherein the additional indicator is a second fluorescent dye, and wherein the indicator and the additional indicator produce a fluorescence resonance energy transfer signal, and wherein the interaction of the analyte with the receptor causes the distance between the indicator and the additional indicator to become altered such that the fluorescence resonance energy transfer signal is altered.

297. The particle of claim 278, wherein the particle further comprises an additional indicator coupled to the receptor, wherein the receptor is coupled to the first linker by a second linker, the indicator is coupled to the first linker by a third linker and the additional indicator is coupled to the receptor by a fourth linker, wherein the indicator is a fluorescent dye and wherein the additional indicator is a fluorescence quencher, and wherein the indicator and the additional indicator are positioned such that the fluorescence of the indicator is at least partially quenched by the additional indicator, and wherein the interaction of the analyte with the receptor causes the distance between the indicator and the additional indicator to become altered such that the quenching of the fluorescence of the indicator by the additional indicator is altered.

298. The particle of claim 278, wherein the particle further comprises an additional indicator coupled to the receptor, wherein the receptor is coupled to the first linker by a second linker, the indicator is coupled to the first linker by a third linker and the additional indicator is coupled to the receptor by a fourth linker, wherein the indicator is a fluorescent dye and wherein the additional indicator is a fluorescence quencher, and wherein the indicator and the additional indicator are positioned such that the fluorescence of the indicator is at least partially quenched by the additional indicator, and wherein the interaction of the analyte with the receptor causes the distance between the indicator and the additional indicator to become altered such that the quenching of the fluorescence of the indicator by the additional indicator

is altered.

299. The particle of claim 278, wherein the particle further comprises an additional indicator coupled to the receptor, wherein the receptor is coupled to the first linker by a second linker,
5 the indicator is coupled to the first linker by a third linker and the additional indicator is coupled to the receptor by a fourth linker, wherein the indicator is a fluorescence quencher and wherein the additional indicator is a fluorescent dye, and wherein the indicator and the additional indicator are positioned such that the fluorescence of the additional indicator is at least partially quenched by the indicator, and wherein the interaction of the analyte with the
10 receptor causes the distance between the indicator and the additional indicator to become altered such that the quenching of the fluorescence of the additional indicator by the indicator is altered.

300. The particle of claim 278, wherein the polymeric resin comprises polystyrene-polyethylene glycol-divinyl benzene.

301. A particle for detecting an analyte in a fluid comprising:

a polymeric resin;

a biopolymer coupled to the polymeric resin; and

an indicator system coupled to the biopolymer, the indicator system producing a signal during use, and wherein the biopolymer undergoes a chemical reaction in the
25 presence of the analyte such that the signal is altered during use.

302. The particle of claim 301, wherein the chemical reaction comprises cleavage of at least a portion of the biopolymer by the analyte.

303. The particle of claim 301, wherein the biopolymer comprises a polynucleotide, and wherein the analyte comprises a nuclease, and wherein the chemical reaction comprises cleavage of at least a portion of the polynucleotide by the nuclease.

5 304. The particle of claim 301, wherein the biopolymer comprises an oligosaccharide, and wherein the analyte comprises an oligosaccharide cleaving agent, and wherein the chemical reaction comprises cleavage of at least a portion of the oligosaccharide by the oligosaccharide cleaving agent.

10 305. The particle of claim 301, wherein the particle indicator system comprises a first indicator and a second indicator, and wherein the chemical reaction of the biopolymer in the presence of the analyte causes a distance between the first and second indicators to become altered such that the signal is produced.

15 306. The particle of claim 689, wherein the first indicator is a fluorescent dye and wherein the second indicator is a fluorescence quencher, and wherein the first indicator and the second indicator are positioned such that the fluorescence of the first indicator is at least partially quenched by the second indicator, and wherein the chemical reaction of the biopolymer in the presence of the analyte causes the first and second indicators to move such that the quenching of the fluorescence of the first indicator by the second indicator is altered.

20 307. The particle of claim 689, wherein the first indicator is a fluorescent dye and wherein the second indicator is a different fluorescent dye, and wherein the first indicator and the second indicator produce a fluorescence resonance energy transfer signal, and wherein the chemical reaction of the biopolymer in the presence of the analyte causes the positions of the first and second indicators to change such that the fluorescence resonance energy transfer signal is altered.

25 308. The particle of claim 301, wherein the indicator system comprises at least one indicator

coupled to the biopolymer, and wherein the chemical reaction of the biopolymer in the presence of the analyte causes the biopolymer to be cleaved such that at least a portion of the biopolymer coupled to the indicator is cleaved from at least a portion of the biopolymer coupled to the polymeric resin.

5

309. A method for forming a sensor array configured to detect an analyte in a fluid, comprising:

forming a cavity in a supporting member;

10

applying a magnetic field to the cavity;

passing a particle over the cavity, wherein the particle is configured to produce a signal when the particle interacts with the analyte, and wherein the particle is configured to interact with the magnetic field such that movement of the particle is inhibited by the applied magnetic field.

15

310. The method of claim 309, wherein forming the cavity comprises anisotropically etching a silicon wafer.

20

311. The method of claim 309, wherein forming the cavity comprises anisotropically etching a silicon wafer such that sidewalls of the cavity are tapered at an angle from about 50 degrees to about 60 degrees.

25

312. The method of claim 309, wherein the applying a magnetic field to the cavity comprises placing a permanent magnet in proximity to the cavity.

313. The method of claim 309, wherein the applying a magnetic field to the cavity comprises:

placing an electromagnet in proximity to the cavity; and

applying an electric current to the electromagnet.

- 5 314. The method of claim 309, wherein the particle comprises a magnetic material.
315. The method of claim 309, wherein the particle comprises a polymeric material and a magnetic material.
- 10 316. The method of claim 309, wherein the particle comprises a polymeric material and an alnico magnetic material.
317. The method of claim 309, wherein the particle comprises a polymeric material and a ferrite magnetic material.
318. The method of claim 309, wherein the particle comprises a polymeric material and a barium ferrite magnetic material.
319. The method of claim 309, wherein the particle comprises a polymeric material and a strontium ferrite magnetic material.
320. The method of claim 309, wherein the particle comprises a polymeric material and a neodymium iron boron magnetic material.
- 25 321. The method of claim 309, wherein the particle comprises a polymeric material and a samarium cobalt magnetic material.
322. The method of claim 309, wherein the particle comprises a polymeric material and a ferromagnetic material.

323. The method of claim 309, wherein the particle comprises a polymeric material and iron oxide.
- 5 324. The method of claim 309, wherein the particle comprises a polymeric material, a metallocene and a metal hydroxide.
325. The method of claim 309, wherein the particle comprises a polymeric material and a magnetic material, and wherein the method further comprises:
- 10 placing the polymeric material and magnetic material in a solvent; and
- applying ultrasound to the solvent.
- 15 326. The method of claim 309, further comprising forming a plurality of cavities in a supporting member;
- applying a magnetic field to at least a first portion of cavities;
- 20 passing a plurality of particles over the cavities, and wherein the particle is configured to interact with the magnetic field such that movement of the particle is inhibited by the applied magnetic field, and wherein the particles are substantially retained within the first portion of the cavities by the applied magnetic field.
- 25 327. A system for detecting an analyte in a fluid comprising:
- a light source;
- a sensor array, the sensor array comprising a supporting member comprising at least one

cavity formed within the supporting member;

a particle, the particle positioned within the cavity, wherein the particle comprises a
receptor coupled to a polymeric resin, wherein the particle further comprises a
magnetically active component to aid in placement of the particle in the array;

a detector, the detector being configured to detect the signal produced by the interaction
of the analyte with the particle during use;

wherein the light source and detector are positioned such that light passes from the light
source, to the particle, and onto the detector during use.

328. The system of claim 327, wherein the system comprises a plurality of particles positioned
within a plurality of cavities, and wherein the system is configured to substantially
simultaneously detect a plurality of analytes in the fluid.

329. The system of claim 327, wherein the light source comprises a light emitting diode.

330. The system of claim 327, further comprising a fluid delivery system coupled to the
supporting member.

331. The system of claim 327, wherein the detector comprises a charge-coupled device.

332. The system of claim 327, wherein a volume of the particle changes when contacted with
the fluid.

333. The system of claim 327, wherein the particle comprises a receptor molecule coupled to a
polymeric resin.

334. The system of claim 327, wherein the particle comprises a receptor molecule coupled to a polymeric resin, and wherein the polymeric resin comprises polystyrene-polyethylene glycol-divinyl benzene.

5 335. The system of claim 327, wherein the particle comprises a receptor molecule coupled to a polymeric resin, and wherein the particle further comprises a first indicator and a second indicator, the first and second indicators being coupled to the receptor, wherein the interaction of the receptor with the analyte causes the first and second indicators to interact such that the signal is produced.

10 336. The system of claim 327, wherein the particle comprises a receptor molecule coupled to a polymeric resin, and wherein the particle further comprises an indicator, wherein the indicator is associated with the receptor such that in the presence of the analyte the indicator is displaced from the receptor to produce the signal.

337. The system of claim 327, wherein the supporting member comprises silicon.

338. The system of claim 327, further comprising channels in the supporting member, wherein the channels are configured to allow the fluid to flow through the channels into and away from the cavity.

339. The system of claim 327, further comprising a barrier layer positioned over the cavity, the barrier layer being configured to inhibit dislodgment of the particle during use.

25 340. The system of claim 327, wherein the barrier layer comprises a substantially transparent cover plate positioned over the cavity, and wherein the cover plate is positioned a fixed distance over the cavity such that the fluid can enter the cavity.

341. The system of claim 327, wherein the supporting member comprises a plastic material.

342. The system of claim 327, wherein the supporting member comprises a dry film photoresist material.

5 343. The system of claim 327, wherein the sensor array comprises a supporting member comprising at least one cavity formed within the supporting member, wherein the cavity is configured such that the fluid entering the cavity passes through the supporting member during use.

10 344. The system of claim 327, wherein a channel is formed in the supporting member, the channel coupling the cavity to a fluid inlet such that the fluid flows from the fluid inlet through the channel to the cavity during use.

345. The system of claim 327, wherein the particle magnetically active component comprises a magnetic material.

346. The system of claim 327, wherein the particle magnetically active component comprises a polymeric material and a magnetic material.

20 347. The system of claim 327, wherein the particle magnetically active component comprises a polymeric material and an alnico magnetic material.

348. The system of claim 327, wherein the particle magnetically active component comprises a polymeric material and a ferrite magnetic material.

25

349. The system of claim 327, wherein the particle magnetically active component comprises a polymeric material and a barium ferrite magnetic material.

350. The system of claim 327, wherein the particle magnetically active component comprises a

polymeric material and a strontium ferrite magnetic material.

351. The system of claim 327, wherein the particle magnetically active component comprises a polymeric material and a neodymium iron boron magnetic material.

5

352. The system of claim 327, wherein the particle magnetically active component comprises a polymeric material and a samarium cobalt magnetic material.

353. The system of claim 327, wherein the particle magnetically active component comprises a polymeric material and a ferromagnetic material.

10

354. The system of claim 327, wherein the particle magnetically active component comprises a polymeric material and iron oxide.

355. The system of claim 327, wherein the particle magnetically active component comprises a polymeric material, a metallocene and a metal hydroxide.

356. A sensor array for detecting an analyte in a fluid comprising:

a supporting member; wherein at least one cavity is formed within the supporting member;

a particle positioned within the cavity, wherein the particle is configured to produce a signal when the particle interacts with the analyte; and wherein the particle further comprises a magnetically active component.

357. The sensor array of claim 356, wherein the particle comprises a receptor molecule coupled to a polymeric resin.

358. The sensor array of claim 356, wherein the supporting member comprises a silicon wafer.
359. The sensor array of claim 356, wherein the cavity extends through the support member.
- 5 360. The sensor array of claim 358, wherein the cavity is substantially pyramidal in shape and wherein the sidewalls of the cavity are substantially tapered at an angle of between about 50 to about 60 degrees.
- 10 361. The sensor array of claim 358, further comprising a substantially transparent layer positioned on a bottom surface of the silicon wafer.
362. The sensor array of claim 358, wherein the silicon wafer has an area of about 1 cm² to about 100 cm².
363. The sensor array of claim 356, further comprising channels in the supporting member, wherein the channels are configured to allow the fluid to flow through the channels into and away from the cavity.
- 20 364. The sensor array of claim 356, further comprising a barrier layer positioned over the cavity, the barrier layer being configured to inhibit dislodgment of the particle during use.
365. The sensor array of claim 364, wherein the barrier layer comprises a substantially transparent cover plate positioned over the cavity, and wherein the cover plate is positioned a fixed distance over the cavity such that the fluid can enter the cavity.
- 25 366. The sensor array of claim 365, wherein the barrier layer comprises plastic, glass, quartz, silicon oxide, or silicon nitride.

367. The sensor array of claim 356, wherein the magnetically active component comprises a magnetic material.

368. The sensor array of claim 356, wherein the particle magnetically active component comprises a polymeric material and a magnetic material.

369. The sensor array of claim 356, wherein the particle magnetically active component comprises a polymeric material and an alnico magnetic material.

370. The sensor array of claim 356, wherein the particle magnetically active component comprises a polymeric material and a ferrite magnetic material.

371. The sensor array of claim 356, wherein the particle magnetically active component comprises a polymeric material and a barium ferrite magnetic material.

372. The sensor array of claim 356, wherein the particle magnetically active component comprises a polymeric material and a strontium ferrite magnetic material.

373. The sensor array of claim 356, wherein the particle magnetically active component comprises a polymeric material and a neodymium iron boron magnetic material.

374. The sensor array of claim 356, wherein the particle magnetically active component comprises a polymeric material and a samarium cobalt magnetic material.

375. The sensor array of claim 356, wherein the particle magnetically active component comprises a polymeric material and a ferromagnetic material.

376. The sensor array of claim 356, wherein the particle magnetically active component comprises a polymeric material and iron oxide.

377. The sensor array of claim 356, wherein the particle magnetically active component comprises a polymeric material, a metallocene and a metal hydroxide.

377. The sensor array of claim 356, wherein the particle magnetically active component comprises a polymeric material, a metallocene and a metal hydroxide.